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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/781,706	02/20/2004	Chandra Mouli	M4065.0986/P986	4202
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DICKSTEIN SHAPIRO LLP 1825 EYE STREET, NW WASHINGTON, DC 20006			EXAMINER VU, HUNG K	
			ART UNIT 2811	PAPER NUMBER
			MAIL DATE 01/10/2008	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/781,706

Applicant(s)

MOULI, CHANDRA

Examiner

Hung Vu

Art Unit

2811

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 31 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-36 and 49-54 is/are pending in the application.
- 4a) Of the above claim(s) 4,5,12,13,17-19,21,25,35,36 and 49-51 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,6-11,14-16,20,22-24,26-34 and 52-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 October 2007 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-3, 6, 7, 10, 11, 14-16, 20, 24, 26-29, 32, 33 and 52-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art of Figures 1A-1B in view of Yoshinori (JP 63-9968, of record).

Applicant's Admitted Prior Art of Figures 1A-1B disclose an image sensor comprising:

a substrate (101) formed over a base layer (102);

a plurality of pixel cells formed within the substrate, each pixel cell comprising a photo-conversion device having a charge collection region (112a,112b) of a second conductivity type (n-type) for accumulating photo-generated charge formed in the substrate below a first region (111a,111b) of a first conductivity type (p-type);

a plurality of trenches (120a,120b), each trench being provided along a perimeter of a respective pixel cell, each trench having sidewalls, and being at least partially filled with a material that inhibits electrons from passing through the trench,

wherein each of the plurality of trenches prevents diffusion of photo-generated charge collected by the photo-conversion device in one pixel cell to an adjacent pixel cell.

Applicant's Admitted Prior Art of Figures 1A-1B do not disclose each trench extending at least to a surface of the base layer. However, Yoshinori discloses an image sensor comprising a substrate (2) formed over a base layer (1), a plurality of trenches and each trench extending at least to a surface of the base layer. Note Figures 1-7 (especially Figure 6) of Yoshinori.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the trench of Applicant's Admitted Prior Art of Figures 1A-1B extending at least to a surface of the base layer (1), such as taught by Yoshinori in order to provide the trench with better isolation of electrostatic induction between the cells.

Regarding claim 2, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the sensor further comprising a dielectric material (10) formed along at least a portion of the sidewalls.

Regarding claim 3, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the dielectric material is an oxide.

Regarding claims 6 and 20, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the material is a conductive material.

Regarding claim 7, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the conductive material comprises one of doped polysilicon, undoped polysilicon and boron-doped carbon.

Regarding claims 10 and 32, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the semiconductor device comprises a CMOS image sensor.

Regarding claims 11 and 24, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the sensor comprises a CCD image sensor.

Regarding claim 14, Applicant's Admitted Prior Art of Figures 1A-1B disclose a structure for isolating an active area on a semiconductor device, the structure comprising:

- a photo-conversion device comprising a doped charge collection region (112a,112b) of a second conductivity type (n-type) for accumulating charge formed in the active area below a first region (111a,111b) of a first conductivity type (p-type);

- a trench (120a,120b) formed in a substrate (101) along at least a portion of a periphery of the active area in the semiconductor device, and wherein the trench has sidewalls;

- a material at least partially fills the trench and inhibits electrons from passing through the trench,

- wherein the trench prevents diffusion of electrons from the doped charge collection region into a region outside the active area.

Applicant's Admitted Prior Art of Figures 1A-1B do not disclose the trench extends at least to a surface of a base layer below the substrate which is below a lower level of the photo-conversion device, a dielectric liner formed along the sidewalls. However, Yoshinori discloses an image sensor comprising a substrate (2) and a base layer (1) below the substrate, and a plurality of

trenches and each trench extending at least to a surface of the base layer and a dielectric liner

(10) formed along the sidewalls. Note Figures 1-7 (especially Figure 6) of Yoshinori.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the trench of Applicant's Admitted Prior Art of Figures 1A-1B extending at least to a surface of the base layer, having a dielectric liner (10) formed along the sidewalls, such as taught by Yoshinori in order to provide the trench with better isolation of electrostatic induction between the cells.

Regarding claims 15 and 27, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the dielectric liner comprises an oxide material.

Regarding claims 16, 28 and 52, the terms "high-density plasma oxide and spin-on dielectric oxide" and "epitaxial" are method recitations in a device claimed. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claim 26, Applicant's Admitted Prior Art of Figures 1A-1B disclose a processing system comprising:

a semiconductor device;

a trench formed in a substrate (101) along at least a portion of a periphery of the active area in the semiconductor device, the active area having a photo-conversion device comprising a charge collection region (112a,112b) of n-type conductivity for accumulating charge and located below a p-type region (111a,111b) of the active area, and wherein the trench has sidewalls and inhibits diffusion of charge outside the active area;

a material at least partially fills the trench.

Applicant's Admitted Prior Art of Figures 1A-1B do not disclose the trench extends at least to a surface of a base layer (1) below the substrate and a dielectric liner (10) formed along the sidewalls. However, Yoshinori discloses an image sensor comprising a substrate (2) and a base layer (1) below the substrate, and a plurality of trenches and each trench extending at least to a surface of the base layer. Note Figures 1-7 (especially Figure 6) of Yoshinori. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the trench of Applicant's Admitted Prior Art of Figures 1A-1B extending at least to a surface of the base layer, having a dielectric liner (10) formed along the sidewalls, such as taught by Yoshinori in order to provide the trench with better isolation of electrostatic induction between the cells.

Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori do not disclose the processing system comprising a processor. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the processing system of Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori comprising a processor since it is conventional and commonly used a processor to control the operating of the system.

Regarding claim 29, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the material comprises one of doped polysilicon, undoped polysilicon and boron-doped carbon.

Regarding claim 33, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the sensor comprises a CCD image sensor.

Regarding claim 53, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the dielectric material is substantially conformal such that thickness of the dielectric material is substantially same along the sidewalls and a bottom of the trench.

Regarding claim 54, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the claimed invention including the sensor as explained in the rejection above. Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori do not disclose the thickness of the dielectric material. Although Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori do not teach the thickness of the dielectric material, as that claimed by Applicants, however, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the dielectric material of Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori having a desired thickness, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).



2. Claims 8, 9, 22, 23, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Admitted Prior Art of Figures 1A-1B in view of Yoshinori (JP 363009968, of record) in view of Clevenger et al. (US 2004/0227061, of record).

Regarding claims 8, 22 and 30, Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori disclose the claimed invention including the sensor as explained in the rejection above.

Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori do not disclose the trench has a depth greater than about 2000 Angstroms. However, Clevenger et al. discloses an image sensor comprising a trench (116A,116B) having a depth greater than about 2000 Angstroms. Note Figure 1-13 and section [0036] of Clevenger et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the trench of Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori having the depth, such as taught by Clevenger et al. in order to have the desired depth to prevent the electrons from passing through the trench.

Regarding claims 9, 23 and 31, Applicant's Admitted Prior Art of Figures 1A-1B, Yoshinori and Clevenger et al. disclose the claimed invention including the sensor as explained in the rejection above. Applicant's Admitted Prior Art of Figures 1A-1B, Yoshinori and Clevenger et al. do not disclose the depth of the trench in the range of about 4000 to about 5000 Angstroms. Although Applicant's Admitted Prior Art of Figures 1A-1B, Yoshinori and Clevenger et al. do not teach the depth of the trench, as that claimed by Applicants, however, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the trench of

Applicant's Admitted Prior Art of Figures 1A-1B, Yoshinori and Clevenger et al. having a desired depth, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

### ***Response to Arguments***

3. Applicant's arguments filed 10/31/07 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

It is argued, at pages 11-12 of the Remarks, that Yoshinori does not disclose the trench 3 below a lower level of the photo-conversion device. This argument is not convincing because, in Figure 6 of Yoshinori, the Examiner uses reference 2 as the substrate and reference 1 as the base layer. Therefore, the combination of Applicant's Admitted Prior Art of Figures 1A-1B and Yoshinori discloses the trenches 3 extend at least to a surface of the base layer and below a lower level of the photo-conversion device.

*Conclusion*

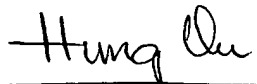
4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung Vu whose telephone number is (571) 272-1666. The examiner can normally be reached on Monday to Thursday 6:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lynne A. Gurley can be reached on (571) 272 - 1670. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Vu

December 31, 2007



Hung Vu

Primary Examiner